Specific Heat Capacity at Constant Volume for {xNH_3 + (1-x)H_2O} at Temperatures from 300 to 520 K and Pressures to 20 MPa

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Thermophysical properties of NH_3 + H_2O mixtures, including heat capacities and densities, are essential input data to optimize the design of power plant equipment which uses this alternative working fluid. To help meet this need, specific heat capacities at constant volume (c_V) of {xNH_3 + (1-x)H_2O} (x≈0.7, 0.8, 0.9) mixtures were measured with an adiabatic calorimeter. This twin calorimeter consists of nearly identical cells which are placed in identical adiabatic shields. Measurements for twice-distilled water, made prior to this study, established the reliable performance of this calorimeter. Temperatures ranged from 300 K to 520 K, and pressures ranged from 3 MPa to 20 MPa. Measurements were conducted on single-phase liquid and compressed gaseous samples. The mixtures were gravimetrically prepared from high purity substances, verified by chemical analysis. Density was reported for initial and final endpoints during each calorimetric experiment. The principal sources of uncertainty are the temperature rise measurement and the change-of-volume work adjustment. The expanded relative uncertainty (with a coverage factor k=2 and thus a two-standard-deviation estimate) for c_V is estimated to be 1 % for liquid-phase and 4 % for gaseous results, and for density it is 0.2 %.